Our Ref: AL: 240294(SO)

18th December 2024

Maitland City Council
PO BOX 220
Maitland NSW 2320

ATTENTION: SCOTT PORTER

RE: STORMWATER MANAGEMENT – SALES OFFICE CARPARK
SOPHIA WATERS STAGE 4A – FUTURE LOT 210

Dear Scott,

ADW Johnson previously prepared detailed design plans for Stage 4A of the Sophia Waters Subdivision. In addition to these plans, ADW Johnson previously prepared 'Stormwater Management Plan – September 2016' for the overall site. This is provided as ***Attachment 1***.

Complementing the aforementioned civil works, it is proposed future Lot 210 is to service the future sales office as a carparking facility**.**

Authority Adherence

The proposed carparking facility has been designed in accordance with the following standards:

- AS 2890.1-2004 Off street car parking;
- AS 2890.6-2009 Off street parking for people with disabilities;
- AS 1428.1-2009 Design for access and mobility; and
- Maitland City Council Manual of Engineering Standards.

Stormwater Management

The proposed car parking site on the corner of Redgate Road and Leenan Road, within Stage 4A of Sophia Waters Subdivision (SW/2023/3) – future Lot 210. The site has been regraded as part of the civil works. Redgate Road and Leenan Road contain stormwater infrastructure as per ADW Johnson's approved Stage 4A civil work plans, draining to the existing stormwater basin within the Sophia Waters development. Lot 210 also has an interallotment drainage pit.

The proposed car parking drainage regime is in accordance with ADW Johnson's stormwater management plan. Site runoff is directed towards two (2) centrally located grated surface inlet pits. Stormwater shall be connected to the IAD pit at the rear of Lot 210.

Hydraulic modelling of the pit and pipe network in Ballymore Drive and the IAD network has been undertaken at Detailed Design phase and included future Lot 210 discharging to the street with an impervious percentage of 60%. The proposed design remains in accordance with the hydraulic modelling previously undertaken.

If you have any questions regarding the above information please don't hesitate to contact the undersigned on (02) 4978 5100 or angusl@adwjohnson.com.au.

Yours faithfully,

ANGUS LIM
CIVIL ENGINEER
ADW JOHNSON
HUNTER OFFICE

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Engineering

Working Beyond Expectations

Stormwater Management Plan

Chisholm Residential Subdivision

Property:
Lots 1 & 2 DP 797020, Lot 1 DP 1144068,
Lots 20 & 21 DP 832786, Lot 1 DP 1032753,
Lot 18 DP 999725 and Lot 1 DP 198776

Applicant:
Allam Property Group, Munro Property Group,
Seccombe, Goodwin & Sidlay

Date:
September 2016

Document Control Sheet

Issue No.	Amendment	Date	Prepared By	Checked By
A	Issue for DA	17/02/2016	K Hughes	S Day
B	Reissued for DA	01/03/2016	K Hughes	S Day
C	Reissued after Council Comments	23/09/2016	K Hughes	L McRae

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Executive Summary

ADW Johnson has been engaged by a Landowners Group comprising of Allam Property Group, Munro Property Group, Seccombe, Goodwin and Sidlay to prepare a Stormwater Management Plan (SWMP) for a catchment within the Thornton North Urban Release Area. The SWMP addresses the stormwater management requirements for the proposed residential subdivision of Lots 1 & 2 DP 797020, Lot 1 DP 1144068, Lots 20 & 21 DP 832786, Lot 1 DP1032753, Lot 18 DP 999725 and Lot 1 DP 198776 adjacent to Raymond Terrace Road (RTR) and McFarlanes Road. This cooperative and collaborative approach of the Landowners Group has stormwater management benefits for Maitland City Council (Council) by reducing the number of controls required to be maintained in order to service the proposed urban development of the catchment. This approach is acceptable based on stream order classifications under the NSW Office of Water guidelines.

The SWMP addresses both stormwater quantity and quality for the proposed development of the catchment. Specifically, on the Allam's site, Basin 1 is the retrofit and upgrade of the existing dam providing post development stormwater management for subcatchments of adjoining properties to the west. Basin 2 is a new basin at the downstream end of an existing subcatchment within the Allam's site that doesn't drain to the existing dam. The existing discharge locations under RTR are maintained at the same point of discharge locations. The first dam immediately upstream of Basin 1 will be removed and the existing dam on Allam's site will cater for the detention and water quality requirements for the development adjacent to this basin. Details of the required stormwater controls will be provided in supplementary reporting when Development Applications are prepared for the upstream properties. As per Councils request modelling has been undertaken to show that the alterations to Basin 1 will not place any extra detention beyond Council's typical pre to post requirements on the upstream properties.

Detention storage has been modelled using the XPRAFTS software and designed to limit the peak runoff from the post developed catchment to less than or equal to the peak runoff of the pre developed catchment for both the larger catchment of the existing dam and the smaller subcatchment from within Allam's site.

The runoff from the smaller subcatchment entering Basin 2 is demonstrated by modelling to be sufficiently attenuated that the 100 year runoff can be conveyed by the existing 750mm diameter pipe culvert crossing. This is an improvement of existing drainage post development.

A MUSIC model was used to simulate pollutant source elements for the proposed development. A water quality system consisting of gross pollutant traps and basins at each discharge point from the Allam's site was then modelled to control pollutants discharging from the proposed development. The water quality pollutant reduction targets of 80%, 45% and 45% for Total Suspended Solids, Total Phosphorus and Total Nitrogen respectively, have been met at both discharge points prior to the runoff entering both culvert crossings of RTR.

The results from this report demonstrate that the proposed detention and water quality system satisfy Council's requirements in relation to anticipated stormwater runoff from the catchment post development. All relevant authority requirements have been met with this design.

1.0 Introduction

ADW Johnson has been engaged by the Landowners Group comprising of Allam Property Group (Allam's site), Munro Property Group, Seccombe, Goodwin and Sidlay to prepare a Stormwater Management Plan (SWMP) a catchment of the Thornton North Urban Release Area. The SWMP is to address the stormwater management requirements for the proposed residential subdivision of Lots 1 & 2 DP 797020, Lot 1 DP 1144068, Lots 20 & 21 DP 832786, Lot 1 DP1032753, Lot 18 DP 999725 and Lot 1 DP 198776 adjacent to RTR and McFarlanes Road.

This cooperative and collaborative approach of the Landowners Group has stormwater management benefits for Council by reducing the number of controls required to be maintained in order to service the proposed urban development of the catchment. This SWMP provides the detail of the specific controls located on the Allam's site to be constructed as part of their proposed development. Specific details of the stormwater management controls within the Landowners Group properties outside of the Allam's site will be addressed via minor supplementary reports, consistent with this 'whole of catchment' SWMP, prepared and submitted as part of future Development Applications on the respective lands. The location of the Landowners Group properties, including proposed development of the Allam's site, are shown in ***Figure 1***.

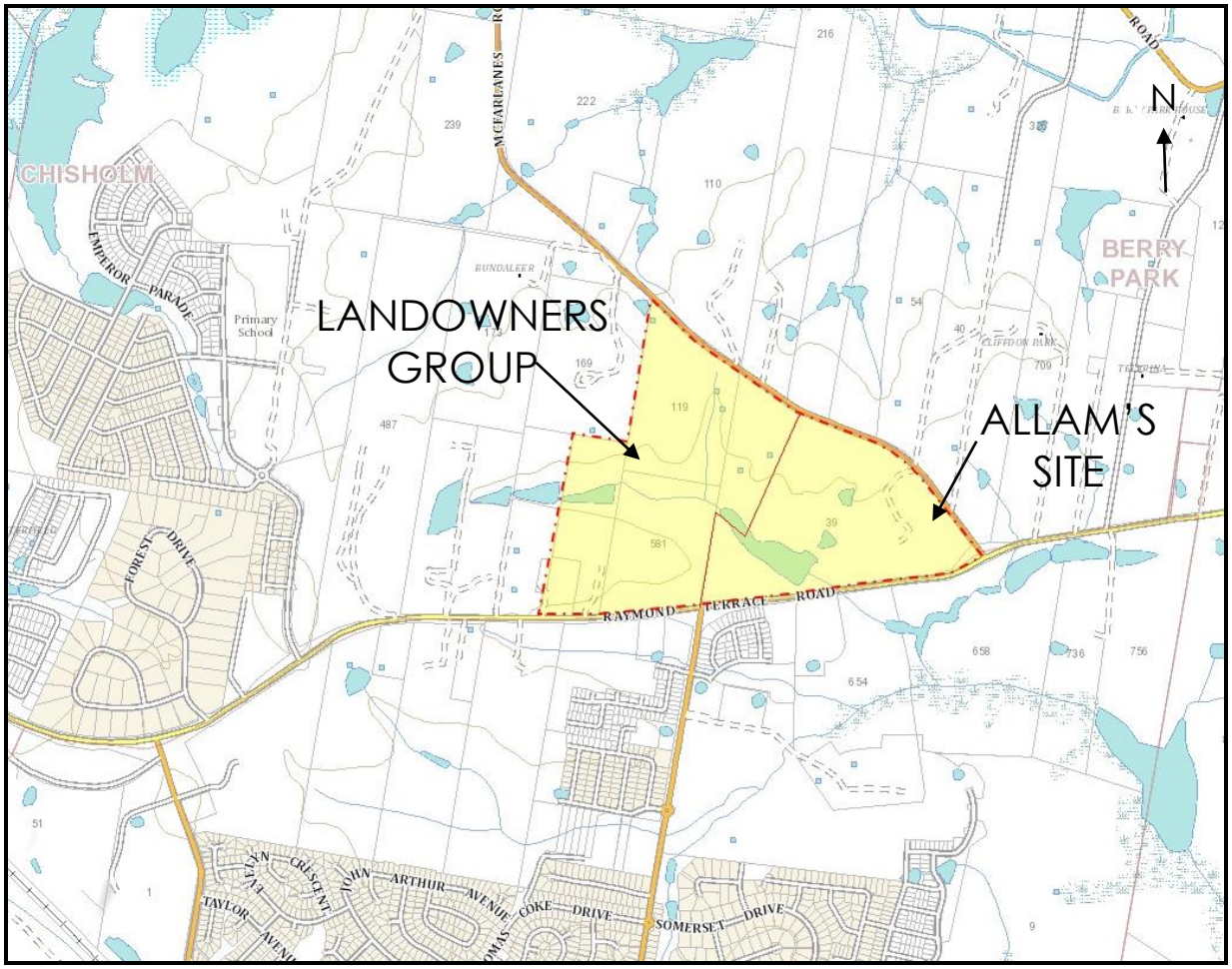

Figure 1 - Site Locality (SIXmaps).

1.1 BACKGROUND REPORTING

"Thornton North Stage 2 Drainage and Riparian Assessment" prepared by GHD for Urbis Pty Ltd, dated February 2009 (GHD Report) was previously completed for which the landowners in this proposed residential area are all included. This report was finalised on the basis of not using the existing dams at the time. A pro rata rate of 310m^3 per hectare of residential development was determined and applied to the area of each lot for determining the approximate detention extents. A pro rata rate of bio retention controls at the rate of 0.012m^2/m^2 was also adopted for water quality purposes. Unfortunately, a recurring typographical or calculation error was made in the final table of per lot requirements in this report which resulted in an overestimation of the bio retention area required by a factor of 10.

From Section 4.4.6 of the GHD Report, the opportunity of utilising the existing dams as the stormwater controls for development was raised for further assessment and investigation with authorities. This is because the main watercourse that the existing dams are located on are first/second order watercourses, which authorities have consistently regarded as acceptable for online stormwater controls to be located. The report describes "*Based on preliminary advice from the DWE* (now known as Department of Primary Industries – Water (DPI-Water)), *it may be possible to incorporate the existing water storages within the release area to achieve the nominated storage volumes required to offset the effects of development.*"

Current DPi-Water requirements and consultation undertaken are described in ***Section 3.0***.

2.0 Site Description

2.1 EXISTING SITE

The Allam's site is located on the northern side of RTR and west of McFarlanes Road. Access to Allam's site is from McFarlanes Road, approximately 350m north of its intersection with RTR. Allam's site consists of slight to moderately undulating terrain and comprises of undeveloped cleared grazing lands and scattered trees. The site contains an existing dam as shown in ***Figure 2***. Allam's site generally slopes towards the existing dam and the intersection of McFarlanes Road and RTR at approximately 2-11%.

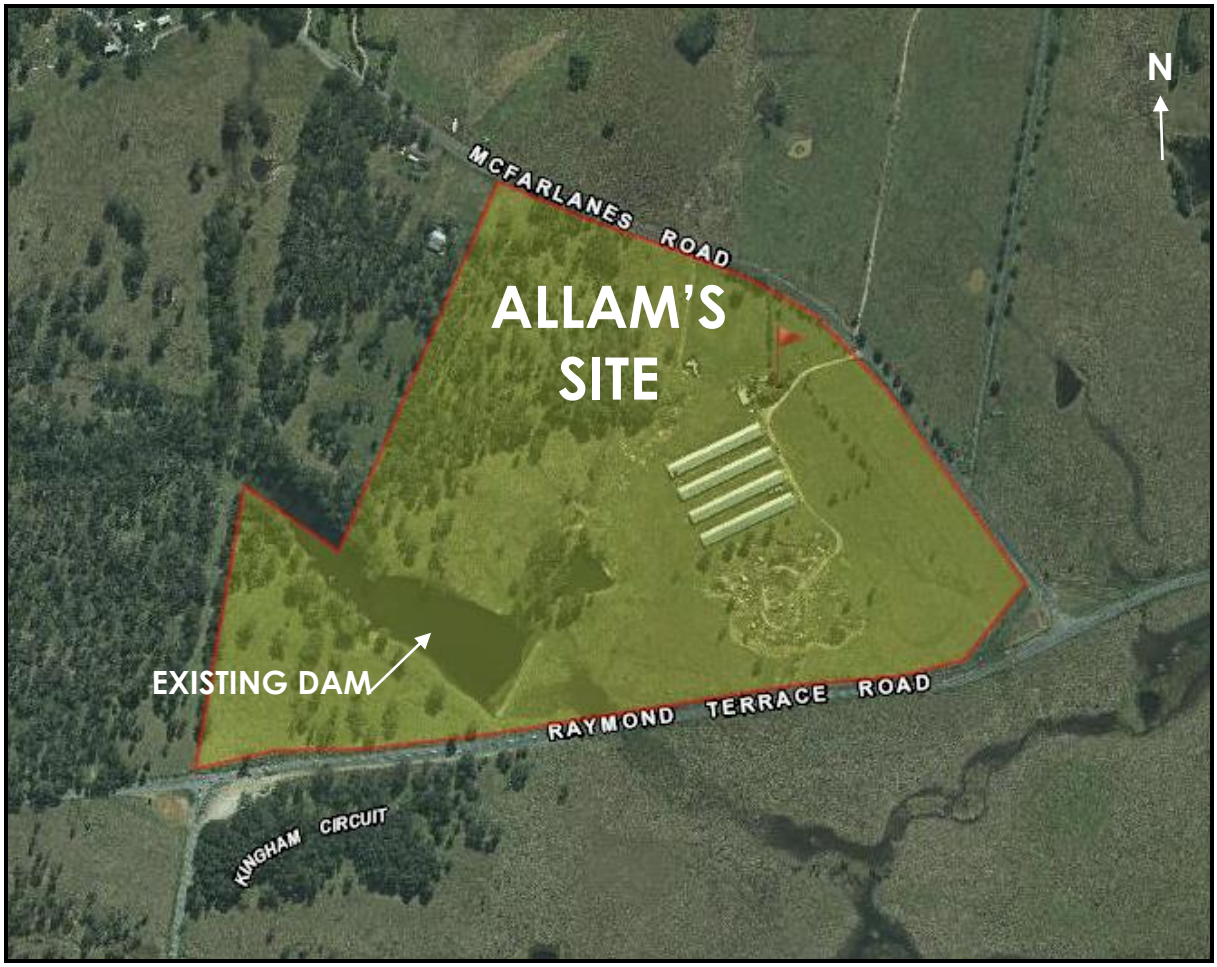

Figure 2 - Existing Site.

The soil profile is expected to be generally residual silty and sandy clays overlying weathered sedimentary rock as outlined in '*Report on Geotechnical Investigation*' prepared by Cardno dated February 2016.

2.2 EXISTING DRAINAGE

As described in ***Section 2.1***, the Allam's site contains an existing dam which collects the majority of stormwater runoff from the Allam's site and some subcatchments of the adjacent, adjoining property. The existing dam is also online, capturing overflow runoff from existing dams upstream and a large upstream catchment area. The area of the natural catchment entering the dam is approximately 99.77ha. The remainder of the site drains towards Raymond Terrace Road undetained.

The existing dam is positioned online at the junction of two (2) first order watercourses. The existing dam has an approximate surface area of 2.08ha and an approximate invert level of 2.0m AHD. The current permanent water level is approximately 4.8m AHD with a spillway located at 5.4m AHD and the berm at 6.6m AHD.

The runoff from the upstream catchment overtopping from the existing dam is conveyed to the south through existing culverts under RTR and released into a large open floodplain where it disperses into Woodberry Swamp. The culverts under RTR downstream of the existing dam are twin 750mmØ pipes.

The eastern portion of the Allam's site drains directly towards RTR and does not enter the existing dam. This catchment crosses RTR through an existing 750mmØ pipe located near the intersection of RTR and McFarlanes Road and disperses into Woodberry Swamp.

Refer to **Exhibit 1.0** for the 1:25,000 topographical map for the catchment.

2.3 PROPOSED DEVELOPMENT

The proposed development of Allam's site covers an area of approximately 34ha, consisting of approximately 290 residential lots for subdivision. The proposed development will comprise of typical urban residential elements such as typical residential lots, roads/footpaths/cycleways, drainage reserves and public parks/open recreational space.

The proposed development is shown in ***Figure 3***.

The existing dam on the Allam's site has been utilised for stormwater detention and quality control for proposed developments upstream of Allam's site as shown in **Exhibit 2.0**.

Catchment areas of the Landowners Group proposed to be residential development in future Development Applications discharging into the Allam's site existing dam from Lot 18 DP 999725, Lot 1 DP 198776, Lot 1 DP 1032753 and Lot 21 DP 832786 are included in the assessment and design of the stormwater management controls proposed in the upgrade of the existing dam facility on Allam's site.

Refer to **Exhibit 2.0**.

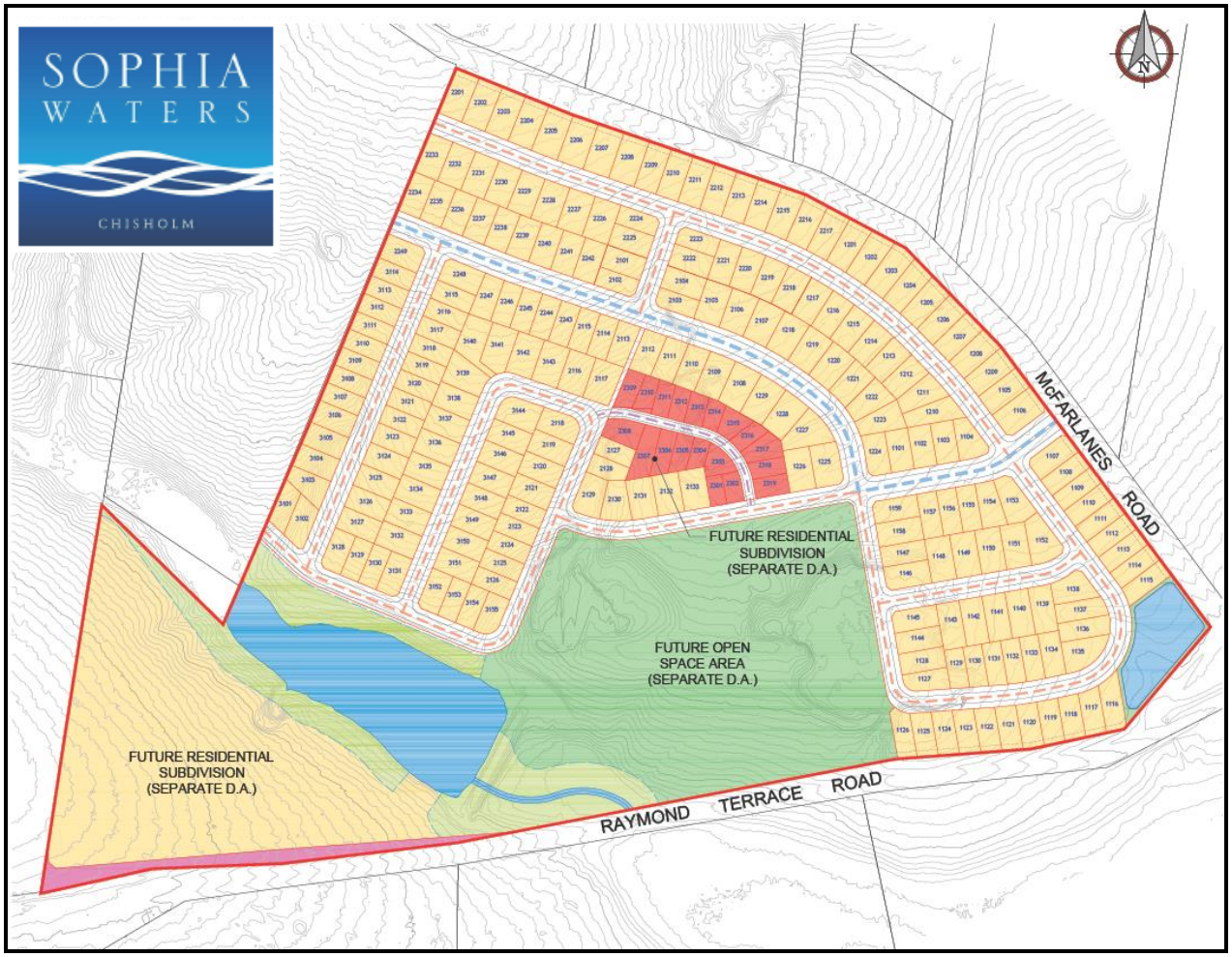

Figure 3 - Proposed Development – Allam's Site.

3.0 Requirements and Consultation

Council outlines the engineering requirements for stormwater management within their *'Manual of Engineering Standards'* (Maitland City Council, 2014).

3.1 DPI-WATER

The Landowners Group, including the Allam's site, have further pursued the opportunity to utilise the existing dams as stormwater controls for the proposed residential development of the catchment. This is permissible in accordance with current NSW State Government Policy, Table 2 – Riparian Corridor Matrix of the "Controlled activities on Waterfront Land – Guidelines for Riparian Corridors on Waterfront Land" which allows for detention basins, stormwater outlet structures and essential services to be online for first and second order watercourses. It is confirmed by the Strahler classification system that the large existing dam is located at the junction of two (2) first order watercourses. The Riparian Corridor width of first order watercourses is 10m either side of the channel.

DPI-Water has issued GTAs for the proposed development and has no objections to this proposal.

3.2 STORMWATER DETENTION

The stormwater detention system is to be designed to ensure that the peak post developed stormwater runoff from the catchment is not greater than the pre developed runoff from the catchment for each of the 1, 10, 20, 50 and 100 year ARI design storm events.

A recognised runoff routing method (XPRAFTS) was used for the computation of the detention requirements.

3.3 STORMWATER QUALITY

The proposed development will include water quality treatment devices within the catchment to reduce pollutant loads to the downstream watercourse. Council's stormwater quality targets are shown in ***Table 3.1***.

Table 3.1 - Water Quality Targets (Maitland City Council, 2014)

Pollutant	Targets
Total Suspended Solids (TSS)	80% of average annual load
Total Phosphorus (TP)	45% of average annual load
Total Nitrogen (TN)	45% of average annual load
Gross Pollutants (GP) (>5mm)	70% of average annual load
Litter (>50mm)	Retention up to the 3 month ARI peak flow
Oil and Grease	90% of average annual load

Appropriate erosion and sediment controls must also be undertaken to ensure pollutants during construction and long term are managed to minimise environmental impact.

3.4 PRE DA MEETING

A pre DA meeting was held with Council on 2nd December 2015. Below is a list of the stormwater requirements raised by Council in a pre DA meeting minutes:

- *Preliminary engineering plans, existing and proposed levels, drainage and water quality strategies and preliminary modelling shall be provided;*
- *Drainage and water quality shall demonstrate that a whole of catchment development scenario has apportioned development flows to achieve a catchment predevelopment discharge rate, and water quality targets. Additionally, floodway levels along the catchment trunk drainage system shall be investigated with the implications on on-line basins in the flowpath and provision of the appropriate freeboard within the drainage corridors;*
- *Basin walls shall be rebuilt/constructed to geotechnical design;*
- *A report and consultation details with the NSW Dam Safety Committee will also be required given the size of the Basin(s) and potential impacts. All necessary steps shall be taken in the design to ensure that the Dam is not required to be "prescribed".*

3.5 DCP REQUIREMENTS

Council's DCP summary of stormwater management requirements is responded to in the Statement of Environmental Effects associated with this Development Application for the Allam's site. The responses are based on the outcomes of this report.

3.6 COUNCIL COMMENTS

Council comments for the proposed development were received on 24th March 2016. In addition to the response package provided by ADWJ on the 15th July 2016, this SWMP has been revised to address the additional drainage requirements raised by Council.

4.0 Stormwater Detention

Following the residential subdivision of land within the catchment, the additional impervious area is likely to result in the increase of stormwater runoff if it is not attenuated. In order to meet Council's requirements of attenuation to pre development runoff levels, as described in **Section 3.2**, the increased stormwater runoff is to be detained in basin structures.

The modelling analysis was undertaken with a recognised runoff routing method (XPRAFTS) to compute peak design runoff from the catchment as well as sizing the detention requirements.

4.1 MODELLING PARAMETERS

4.1.1 Rainfall Intensity

The Rainfall Intensity Frequency Duration (IFD) data adopted was sourced from the Bureau of Meteorology website (IFD AR&R87 application). This was then checked against the IFD data contained in Appendix C of Council's *'Manual of Engineering Standards'*.

4.1.2 XPRAFTS Parameters

The key parameters utilised within the XPRAFTS model are summarised in ***Table 4.1*** below.

Table 4.1 - XPRAFTS Modelling Parameters

Parameter	Pervious Area	Imperious Area
Manning's 'n'	0.05 – Natural	0.015
	0.035 - Developed	
Initial Loss (IL)	5.0mm	1.0mm
Continuing Loss (CL)	2.5mm/hr	0mm/hr

The parameters outlined in ***Table 4.1*** were sourced from both Council's *'Manual of Engineering Standards'* and Australian Rainfall and Runoff (Edition 3 – 1987) *'A Guide to Flood Estimation'* (Pilgrim, 1987).

4.2 SUBCATCHMENTS

Subcatchments were delineated by analysis of the field survey undertaken as well as (Lidar) topographical survey information and then confirmed by ground truthing inspection.

4.2.1 Predeveloped Catchment

The overall predeveloped catchment includes a large upstream area located on adjoining properties. Runoff from this upstream catchment drains from the neighbouring properties through a series of existing dams including the existing dam on the Allam's site, as described in ***Section 2.2***. The area included in the pre developed runoff calculations is shown in the predeveloped catchment plan provided as ***Exhibit 2.0*** and the areas of each subcatchment are outlined in ***Table 4.2*** below.

The existing Allam's site has a mix of both pervious (paddock areas) and impervious area (sheds and dams) as shown in ***Figure 2***. For the purposes of stormwater modelling, the existing sheds and dams have been ignored in the calculation of the pre developed site impervious area, to conservatively estimate the appropriate level of detention storage.

A summary of the subcatchment parameters used are shown in ***Table 4.2*** and ***Exhibit 2.0.***

Table 4.2 - Pre Developed Catchment Parameters

Subcatchment	Total Area (ha)	% Impervious
NAT 1.0	14.06	0
NAT 2.0	9.70	0
NAT 3.0	11.08	0
NAT 4.0	1.73	0
NAT 4.1	3.98	0
NAT 5.0	2.63	0
NAT 5.1	2.15	0
NAT 6.0	2.04	0
NAT 6.1	5.00	0
NAT 7.0	1.30	0
NAT 7.1	1.83	0
NAT 8.0	1.81	0
NAT 8.1	9.05	0
NAT 8.2	2.90	0
NAT 9.0	1.24	0
NAT 9.1	4.34	0
NAT 10.0	4.58	0
NAT 11.0	1.14	0
NAT 11.1	3.63	0
NAT 12.0	7.76	0
NAT 13.0	1.45	0
NAT 13.1	6.39	0
NAT 14.0	8.03	0
NAT 15.0	7.83	0
TOTAL	**115.63**	**0**

4.2.2 Post Developed Catchment

The post developed subcatchment areas were determined by CAD measurement of the proposed development layouts over the adjoining landowners' properties and based upon concept engineering design works on Allam's site. The post developed catchment includes the upstream natural subcatchments NAT 1.0 – 3.0, developed subcatchments DEV 1.0 – 8.0 and the watercourse and riparian zone A1 – A4. Development has been allowed for in subcatchments notated DEV, including some development of the neighbouring properties outlined in ***Section 1.1*** and shown in the post developed catchment plan ***Exhibit 3.0.*** A summary of the catchment parameters are shown in ***Table 4.3***.

An allowance for impervious areas has been applied to A1-A4 subcatchments to reflect the extent of permanent water surface area and future road crossings of the proposed development.

Table 4.3 - Post Developed Catchment Parameters

Subcatchment	Total Area (ha)	% Impervious	Area (ha) Impervious	Area (ha) Pervious
NAT 1.0	14.06	0	0.00	14.06
NAT 2.0	9.70	0	0.00	9.70
NAT 3.0	11.08	0	0.00	11.08
DEV 1.0	18.34	60	11.07	7.27
DEV 2.0	14.63	63	9.25	5.38
DEV 3.0	9.00	63	5.68	3.32
DEV 4.0	5.44	63	3.45	1.99
DEV 5.0	13.30	63	8.33	4.97
DEV 6.0	4.56	10	0.46	4.10
DEV 7.0	1.54	40	0.61	0.93
DEV 8.0	7.79	60	4.67	3.11
A1	2.74	10	0.27	2.46
A2	2.22	10	0.22	2.00
A3	3.97	52	2.08	1.89
A4	0.97	10	0.10	0.88
TOTAL	**119.34**		**46.2**	**73.15**

Council's standard level of imperviousness for the modelling of residential subdivisions has been adopted for subcatchments DEV 1.0, DEV 2.0, DEV 3.0, DEV 4.0, DEV 5.0, DEV 7.0 and DEV 8.0. From ***Table 4.3***, the fraction of impervious area for subcatchment DEV 6.0 is lower than standard values for residential areas as this subcatchment include large areas of pervious parklands located within the proposed development of Allam's site.

The post developed catchment is 3.71ha larger than the predeveloped catchment. This can be attributed to the redirection of part of catchment DEV 2.0 towards Basin 1. The remaining catchment fronting Raymond Terrace Road will be dealt with in future stormwater reports and addendums.

4.3 XPRAFTS MODEL CALIBRATION

For modelling accuracy, the hydrological model results were compared to the previous assessment by GHD, detailed in ***Section 1.1,*** refer to ***Table 4.4*** below.

Note the pre developed peak flow rate calculated in this revision of the report has increased since the previous revision. This is due to the removal of storage in the modelling of the dams on the adjoining properties as per Councils comments in the request for additional information provided on the 24th March 2016.

Table 4.4 – Model Runoff Comparison

Report	Storm Event	Runoff (m^3/s)
ADWJ Report	100yr ARI	17.2
Rational Method	100yr ARI	14.2
GHD Report	100yr ARI	14.8

The pre developed peak runoff was calculated using XPRAFTS and compared to the Rural Rational Method. The rational method was used in conjunction with a time of concentration calculated conventionally using the kinematic wave equation and lag times. From the rational method, a default Storage Coefficient Multiplication Factor (Bx) of 1.2 was adopted within the XPRAFTS model.

The GHD report on this catchment is part of a broader regional report that looks at a series of catchments in the Thornton North region rather than focusing on the runoff generated from this catchment alone. Having to cover a much greater regional area, GHD breaks the predeveloped subcatchments down into larger areas with less respect for changes in slope and lag times throughout the catchment. One particular difference in XPRAFTS modelling that could be attributed to the difference in predeveloped runoff is a higher initial loss assumed in the GHD model. GHD assumed an initial loss of 12mm for pervious areas. By comparison, our modelling assumption of initial loss was 5mm. An initial loss of 5mm is consistent with Council's recommendations, moderate slopes and with the clay soils types present in the area.

Apart from this difference the difference in peak flows calculated in the GHD report may be attributed to other modelling differences such as lag times, catchment break down, catchment slopes or the Storage Coefficient Multiplication Factor (Bx).

4.4 PROPOSED DETENTION BASINS

The iterative process of the basin design to meet the requirements of Council resulted in the detention basins outlined in the following ***Sections 4.4.1-4.4.2.***

All basins will be utilised for stormwater quality in addition to stormwater detention.

General arrangements of the stormwater controls within the Allam's site can be found in ***Exhibit 4.0***.

4.4.1 Basin 1

The large existing dam on the south western side of Allam's site is to be maintained in the post development scenario and is referred to herein as Basin 1. Basin 1 has been designed to cater for the rainfall runoff form the following catchments; NAT 1.0 – NAT 3.0, A1- A3 and DEV 1.0 - 6.0 as shown in the post developed catchment plan in ***Exhibit 3.0***. The outlet controls have been designed for Basin 1 to ensure that runoff from the proposed development does not increase from its existing pre developed state.

The basin design details are summarised in ***Table 4.5.***

Table 4.5 - Basin 1

Basin Parameter	Detail
Levels	2.0m AHD – Invert Level
	4.6m AHD – Permanent Water Level
	6.55m AHD – Berm Level
Basin Area	Permanent Water Area 2.08ha
Batters	1:6 for egress
	1:4 max elsewhere
Outlet Controls	Pit – 1.2x1.2m – Grate IL 4.7m AHD with 0.1mx0.1m low flow outlet at 4.6m AHD
	Pipe – 0.9mØ pipe – IL 3.5m AHD
	Box Culverts – 3 x 0.9(h)x3(w)m culvert – IL 5.4m AHD
	Weir (Spillway) – 7m length, 1:4 sides – IL 6.15m AHD
Total Storage at 100yr Stage (above the permanent water level)	33,725 m³
Permanent Pool Volume	25,700 m³

To ensure the structural safety of the basin in conjunction with the management of larger storm events, the capacity to convey runoff from the 500 year ARI storm event occurring over the catchment was checked. During such an event, modelling indicated that Basin 1 did not spill over the berm level of 6.55m AHD.

The post developed flood level and extent for all regular storm events up to and including the 1 year storm event is unchanged from the predeveloped level. High frequency events, such as events up to the 1 year ARI, have the greatest potential for impact on riparian vegetation as they are the storm events expected to occur frequently through the lifecycle of the vegetation. Therefore, the riparian vegetation is not expected to be impacted since there is no change of inundation when comparing the pre to post developed scenarios for these minor storm events.

4.4.2 Basin 2

Basin 2 is located within Allam's site adjacent to the intersection of McFarlanes Road and RTR and has been designed to cater for runoff from subcatchment DEV 9.0, refer to Exhibit 3.0. Basin 2 is a dry bio retention basin.

The capacity of the existing culvert under RTR was found to be approximately 1.2 m³/s. The culvert was found to be under capacity for the existing predeveloped 20, 50 and 100 year storm events. Therefore, Basin 2 has been designed to further detain the runoff from these design storm events to a level that can be conveyed by the existing culvert.

The basin design details are summarised in ***Table 4.6***.

Refer to ***Exhibit 6.0*** for a general arrangement plan of Basin 2.

Table 4.6 - Basin 2

Basin Parameter	Detail
Levels	4.8m AHD – Invert Level
	6.5m AHD – Berm Level
Basin Area	Basin Floor Area – 1726m²
Batters	1:6 for egress
	1:4 max elsewhere
Outlet Controls	Pit – 1.2x1.2m – Grate IL 5.1m AHD
	Pipe – 0.375mØ pipe – IL 4.1m AHD
	Pit - 1.2x1.2m – Grate IL 5.4m AHD
	Pipe - 0.6mØ pipe – IL 4.05m AHD
	Weir (Spillway) – 3m length, 1:4 sides – IL 6.20m AHD
Total Storage at 100yr Stage	2,240 m³

To ensure the structural safety of Basin 2 in conjunction with the management of larger storm events, the capacity to convey runoff from the 500 year ARI storm event was checked. During such an event modelling indicated Basin 2 did not spill over the berm level of 6.5m AHD.

4.5 STORMWATER DETENTION RESULTS

XPRAFTS modelling for the 1 to 100 year ARI design storms was undertaken including both pre and post developed catchments. ***Tables 4.7 and 4.8*** summarise the peak runoff at the two discharge points from the Allam's site.

Table 4.7 – Catchment of Basin 1 Modelling Results

Storm Event (ARI)	Peak Runoff (m³/s)		
	Pre Developed	Post Developed (w/o detention)	Post Developed (with detention)
1yr	2.13	9.00	2.05
10yr	9.03	20.55	7.72
20yr	11.62	24.65	9.67
50yr	14.55	28.16	11.92
100yr	17.19	32.26	14.31

The existing culvert system under RTR, downstream of Basin 1, comprises twin 750mmØ RCP's. The capacity for conveyance of runoff through this existing culvert system is calculated to be a total of approximately 2.2m³/s, being less than the 10 year ARI runoff from the upstream catchment prior to any proposed development. Council's existing drainage system is considered inadequate at this location. For safety reasons and because RTR is a major road, the existing culvert system has required upgrade by Council for quite some time. It has been calculated that upgrade to three 0.75m high x 2.7m wide RCBC will reduce the inundation level of overflow and frequency of overtopping of RTR during rain events. The upgrade of the RTR crossing will increase the capacity, without

blockages, to approximately 16.0m³/s for conveyance of 100 year runoff from the upstream catchment.

The results from XPRAFTS modelling for Basin 2 are shown below in ***Table 4.8***.

Table 4.8 – Catchment of Basin 2 Modelling Results

Storm Event (ARI)	Peak Runoff (m³/s)		
	Pre Developed	Post Developed (w/o detention)	Post Developed (with detention)
1yr	0.35	0.97	0.32
10yr	0.97	2.27	0.90
20yr	1.22	2.69	0.95
50yr	1.47	3.04	1.00
100yr	1.73	3.46	1.18

As shown in ***Tables 4.7 and 4.8***, Council's requirement to reduce the post developed runoff to equal or less than the predeveloped runoff was successfully achieved from both discharge points from the Allam's site.

As can be seen above, the peak runoff from Basin 2 for the 20, 50 and 100 year events are significantly lower than the pre developed runoff. This is because the existing predeveloped runoff from this catchment has been found to exceed the 1.2m³/s capacity of the existing culvert at RTR. Hence, Basin 2 has been designed to mitigate this issue by detaining runoff to the capacity of the existing culvert and won't inundate RTR. This decrease in peak runoff is not expected to have any detrimental effects downstream.

The modelling results of peak stage and water levels for the 1 to 100 year ARI storm event for each Basin are summarised in ***Table 4.9***.

Table 4.9 - Basin Peak Stage and Detention Water Level – Modelled Results

Storm Event (ARI)	Basin Peak Stage and Water Level	
	Basin 1	Basin 2
1yr	2.79 m	0.68m
	5.39m AHD	5.48m AHD
10yr	3.29m	1.04m
	5.89m AHD	5.84m AHD
20yr	3.40m	1.21m
	6.00m AHD	6.01 AHD
50yr	3.51m	1.36m
	6.11m AHD	6.16m AHD
100yr	3.62m	1.48m
	6.22m AHD	6.28m AHD

The results shown in ***Table 4.9*** are dependent on the upstream properties within the catchment achieving the standard target of pre to post development attenuation of peak runoff for all design storms up to and including the 100 year storm event. Basin 1 is designed to treat and detain stormwater for developments marked DEV only.

Supplementary reports or addendums will be required future Development Applications over these adjacent properties.

As per Councils request modelling was conducted to show that the modifications to Basin 1 would not result in excessive detention requirements on the upstream properties draining towards Basin 1. To do this the hydrographs from the upstream natural catchment and the developed catchments entering Basin 1 were exported from XPRAFTS for the critical duration storm. The hydrographs were then translated so that the peak flows from both catchments aligned and the flows at each time step were added. This new hydrograph was then imported directly into Basin 1 to model how changes in the timing of the upstream flows would impact the performance of the basin.

The results in comparison to the predeveloped flows are summarised in Table 4.10.

Table 4.10 – Results of Upstream Catchment Modelling

Storm Event (ARI)	Peak Runoff (m^3/s)	
	Pre Developed	Combined peak flow modelling
1yr	2.13	2.03
10yr	9.03	7.71
20yr	11.62	9.93
50yr	14.55	12.71
100yr	17.19	15.62

As can be seen from Table 4.10 flows at the end of the catchment was not increased above the predeveloped peak flowrate regardless of the timing of the flows entering Basin 1 from upstream. Therefore, excessive detention will not be required to be placed on the upstream properties.

5.0 Stormwater Quality

Water quality improvement of the runoff from the proposed development requires a treatment train for pollution reduction. The treatment train effectiveness was determined using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC). The MUSIC model was used to simulate pollutant source elements and the treatment of the pollutant loading using treatment devices. The object for sizing the treatment devices is to meet Council's pollution reduction targets outlined in ***Table 3.1***.

5.1 MUSIC MODELLING PARAMETERS

5.1.1 Rainfall and Evapotranspiration

The rainfall data from Tocal, Paterson weather station was input into the MUSIC model. Six (6) minute rainfall information for the year 1989 was analysed and deemed to be a reasonable representation of the average yearly rainfall and rainfall event distribution.

The rainfall data file was reviewed and it was noted that the rainfall for 1989 (904.6mm) was comparable to the annual average for the 47 year period from 1967 to 2015 being 930.4mm. During 1989 there were 89 days of rainfall which is equivalent to the long term average of 89.9.

The average monthly area Potential Evapotranspiration (PET) rates for the Allam's site were sourced from Bureau of Meteorology. The PET values for the model are summarised in ***Table 5.1.***

Table 5.1 - Monthly Average Area Potential Evapotranspiration (Bureau of Meteorology, 2015)

Month	Average PET (mm/month)
January	180
February	155
March	150
April	115
May	75
June	70
July	65
August	95
September	125
October	150
November	175
December	200

The annual rainfall and evapo-transpiration time series graph for 1989 is shown in ***Figure 4.***

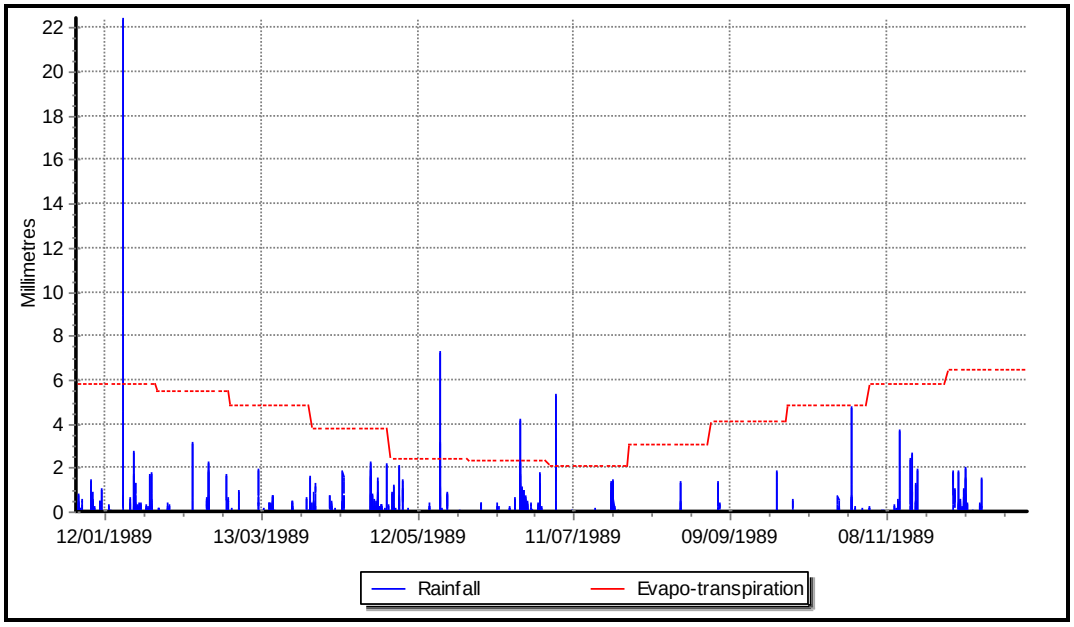

Figure 4 - Rainfall and Evapo-transpiration Graph.

5.1.2 Time Step

A time step of six (6) minutes was specified prior to any modelling. This is recommended by the software to increase reliability and output sensitivity.

5.1.3 Catchment Plan

The subcatchments used in ***Section 4*** have been combined into three (3) subcatchments for the purpose of MUSIC modelling. These catchments are outlined in ***Table 5.2.***

Table 5.2 - MUSIC Catchment Areas

Catchment	Subcatchment (Section 4)	Area (ha)
1	NAT 1.0 – 3.0, A1- A4 & DEV 1.0 -7.0	111.55
2	DEV 8.0	7.79
	Total	119.34

As per Councils request, the upstream natural catchments have been added to the MUSIC modelling in this revision of the SWMP.

To maintain and protect all sections of the downstream watercourses, the water quality targets outlined in ***Table 3.1*** will be checked and applied downstream of catchments 1 and 2.

5.1.4 Land Use

The MUSIC model defined the following land uses:

- Roof (Urban) – This land use defines the impervious roof area of each lot, it has been assumed to be 100% impervious and accounts for:
    - 60% of the total lot area;
- Lots (Urban) – This land use defines the lot area after the removal of the roof area, it has been assumed to be:
    - 5% impervious of 40% of the remaining lot area;
- Road (Urban) – This land use defines the road reserve area, it has been assumed to be 70% impervious accounting for pervious road verge;
- Basin Area (Urban) – This land use defines the basin area, it has been assumed to be 100% impervious;
- Landscaping (Urban) – This land use defines parklands and general open space, it has been assumed to be 10% impervious; and
- Upstream Natural (Urban) – This land use defines the upstream natural catchments and it has been assumed to be 0% impervious.

Total lot area equates to 62% impervious area.

Table 5.3 summarises the land use areas for each subcatchment.

Table 5.3 - Subcatchment Land Use Areas

Land Use	Subcatchment (ha)	
	1	3
Roof	25.24	2.86
Lot	16.83	1.91
Road	18.54	2.10
Basin	2.08	0.17
Open Space	14.02	0.74
Upstream Natural	34.84	-

5.1.5 Rainfall-Runoff Parameters

Pollutant source inputs were obtained from the *'Draft NSW MUSIC Modelling Guidelines'* (BMT WBM, 2010). The parameters adopted for the varying land uses were implemented in accordance with Table 3-2 and 3-7 of the above stated document assuming a CLAY soil description.

The parameters used within the MUSIC model are presented in ***Tables 5.4*** and ***5.5.***

Table 5.4 - MUSIC Rainfall-Runoff Parameters

Parameter	Roof	Lot	Road	Basin	Open Space
Areas - Impervious (%)	100	5	70	100	10
Areas - Pervious (%)	0	95	30	0	90
Rainfall Threshold (mm/day)	0.3	1	1.5	1	1
Soil Storage Capacity (mm)	93	93	93	93	93
Initial Storage (% of Capacity)	30	30	30	30	30
Field Capacity (mm)	68	68	68	68	68
Infiltration - a	135	135	135	135	135
Infiltration - b	4	4	4	4	4
Initial Depth (mm)	10	10	10	10	10
Daily Recharge Rate (%)	10	10	10	10	10
Daily Baseflow Rate (%)	10	10	10	10	10
Daily Deep Seepage Rate (%)	0	0	0	0	0

Table 5.5 - MUSIC Model Baseflow and Stormflow Pollutant Concentrations

Land Use		Mean Concentration		
		TSS	TP	TN
		mg/L	mg/L	mg/L
Roof	Baseflow	15.8	0.141	1.29
	Stormflow	20	0.129	2
Lot	Baseflow	15.8	0.141	1.29
	Stormflow	141	0.251	2
Road	Baseflow	15.8	0.141	1.29
	Stormflow	269	0.501	2.19
Basin	Baseflow	15.8	0.141	1.29
	Stormflow	141	0.251	2
Open Space	Baseflow	15.8	0.141	1.29
	Stormflow	141	0.251	2

5.2 TREATMENT DEVICES

The treatment train within the MUSIC model considered the following stormwater quality improvement devices, following the naming convention of devices from MUSIC:

- Rainwater Tanks;
- Gross Pollutant Traps (GPTs);
- Existing Pond; and
- Bio Retention Basin.

5.2.1 Rainwater Tanks

Rainwater tanks are at source controls. They are to be used for harvesting and re-use of roof water on each lot as each dwelling is required to comply with BASIX requirements. ***Table 5.6*** outlines the parameters utilised within the MUSIC model.

Table 5.6 - Rainwater Tank Parameters

Parameter	Input
Volume below overflow pipe (L)	2000
Depth above overflow pipe (m)	0.2
Surface Area (m^2)	2.5
Overflow Pipe diameter (mm)	50
Daily reused (kL/day/dwelling)	0.3

The daily reuse is based on the assumption of two (2) people per lot reusing water for laundry, toilets and outdoor uses.

5.2.2 Gross Pollutant Traps

Gross Pollutant Traps (GPTs) are utilised as conveyance controls of litter and heavy sediment, though they can also be used as an end of line control. The **Ecosol In-Line GPT** was modelled as the GPTs treatment device. The treatment node was sourced from the Ecosol website. (Ecosol Pty Ltd, 2014). It is proposed that at construction certificate stage, gross pollutant traps will be positioned throughout the development to intercept majority of stormwater discharging from the developed, ensuring that the GPTs are serviceable and remain efficient during smaller duration storm events.

The removal efficiency of the GPT is summarised in ***Table 5.7***.

Table 5.7 - GPT Removal Efficiencies

Pollutant	% Removal Efficiency *
Total Suspended Solids	55
Total Phosphorus	40
Total Nitrogen	40
Gross Pollutants	99
Total Petroleum/Hydrocarbon	99

* (Ecosol Pty Ltd, 2015)

The high flow bypass for the modelled GPTs has been set to the calculated 3 month flow (approx. ½ of 1 year ARI) from each subcatchment.

5.2.3 Pond

Basin 1 is equivalent to a 'Pond' in the MUSIC model. The pond is utilised as the end of line control for catchment 1 and therefore treats the water prior to discharging offsite. Pollutant removal is achieved through the process of providing extended detention time to allow for sedimentation and some biological and chemical uptake. ***Table 5.8*** outlines the parameters for the pond.

Table 5.8 – Pond Parameters (Basin 1)

Parameter	Existing Pond
Surface Area Required to meet Council Targets (m^2)	0.80ha
Actual Surface Area (m^2)	2.08ha
Extended Detention Depth (m)	0.1
Permanent Pool Volume (m^3)	25,700
Initial volume (m^3)	25,700
Exfiltration Rate (mm/hr)	0
Evaporation Loss as % of PET	100

5.2.4 Bio Retention Basin

Bio retention basins are utilised as end of line controls and therefore treat the water prior to discharging offsite. Basin 2 is being constructed providing opportunity for a bio retention treatment component to treat the stormwater from catchment 3.

Table 5.9 – Basin 2 Parameters

Parameter	Bio retention Basin
Surface Area (m^2)	1723
Extended Detention Depth (m)	0.3
Exfiltration Rate (mm/hr)	0
Filter Area (m^2)	10
Filter Depth (m)	0.4
Saturated Hydraulic Conductivity	150
Base Lined	no
Vegetated with Nutrient Removal Plants	yes
Underdrain Present	yes
Submerged Zone	no

The bio retention basin is to partially contain the infiltration media as the entire base area is not required to achieve Council's pollutant reduction requirements.

5.3 TREATMENT TRAIN

The treatment train defines the stormwater quality improvement devices used for the removal of pollutants from each subcatchment. ***Table 5.11*** outlines the treatment train for each subcatchment.

Table 5.11 - Treatment Train

Catchment	Treatment Train
1	1 Rainwater Tank on each proposed lot, GPT, Existing Pond
2	1 Rainwater Tank on each proposed lot, GPT, Bio Retention Basin

5.4 WATER QUALITY RESULTS

To show compliance with Council's requirements, the following modelling results are to be compared against Council's pollution reduction targets outlined in ***Table 3.1***.

The petroleum/hydrocarbon target reductions required by Council's are to be achieved through the use of GPTs. GPTs are not specifically designed to capture hydrocarbons, though they may do so during emergency spill events. The petroleum/hydrocarbon pollutant reduction of 99% for the GPT as outlined in ***Section 5.2.2*** exceeds Council's requirements and therefore shows qualitative compliance provided maintenance is undertaken immediately after an emergency spill event. Simulations of these pollutants are beyond the functionality of the MUSIC program and therefore no quantitative results can be provided.

The average annual pollutant loads downstream of catchments is summarised in ***Table 5.12.***

Table 5.12- Treatment Train Effectiveness

Catchment	Pollutant	Developed	Developed Treated		Council Target Reduction (%)
		Load	Load	Reduction (%)	
1	TSS (kg/yr))	53000	8340	**84.3**	**80**
	TP (kg/yr)	112	39.5	**64.8**	**45**
	TN (kg/yr)	876	444	**49.3**	**45**
	GP (kg/yr)	11600	41.7	**99.6**	**70**
2	TSS (kg/yr))	5240	719	**86.3**	**80**
	TP (kg/yr)	11.5	5.3	**53.9**	**45**
	TN (kg/yr)	91.7	46.7	**49.1**	**45**
	GP (kg/yr)	1310	0	**100**	**70**

From ***Table 5.12***, it can be seen that the treatment train successfully reduced the pollutant loading from the development.

6.0 Erosion and Sediment Control

Maitland City Council requires the use of erosion and sediment controls to manage and contain pollutant runoff, both during construction and as long term permanent treatments thus ensuring the minimisation of impact on the environment. All erosion and sediment controls and practices are to be in accordance with *'Managing Urban Stormwater'* by Landcom/NSW Department of Housing.

Long term permanent treatments are outlined in ***Section 5***. The treatment train specified has been shown to sufficiently manage and control the pollutants leaving the development in accordance with Council's pollutant reduction targets.

Treatment devices will be utilised to contain the generated pollutants for proposed development. These include but are not limited to:

- Sediment Basins;
- Silt Fencing;
- Haybale and Geotextile Fencing;
- Kerb Inlet Controls;
- Sandbag Kerb Inlet Sediment traps;
- Shaker Ramp; and
- Diversion Drains.

The clean water entering the Allam's site from upstream catchments is to be diverted around the construction site where possible, hence remaining clean. Runoff generated from within the Allam's site is to be treated and managed using a combination of the above stated treatment devices.

Due to the extents of disturbed areas, the use of sediment basins will be required (Landcom, 2004). During construction, the proposed basins will be utilised as sediment basins. These basins are to be constructed as the stormwater quality/quantity basins once the majority of construction works have occurred.

Refer to ***Appendix C*** for an Erosion and Sediment Control Plan. A specific ESCP will be required for each stage of the development with the associated Construction Certificate. This plan also details the management of the watercourse during construction.

7.0 Key Compliances

7.1 PRE DA MEETING

Below is a list of the stormwater requirements raised by Council in a pre DA meeting. Following the requirements are the responses and actions that have been taken to meet these requirements.

Preliminary plans, levels, drainage and water quality strategies and modelling shall be provided.

- Preliminary engineering plans showing existing and proposed levels can be found in the Exhibits. The site drainage strategy and water quality strategy can be found in ***Section 4*** and ***Section 5*** respectively.

Drainage and water quality shall demonstrate that a whole of catchment development scenario. Additionally, floodway levels along the catchment trunk drainage system shall be investigated.

- A whole of catchment approach has been adopted throughout the detention and water quality modelling in this report. As further discussed in ***Section 4*** the large existing dam has been upgraded to incorporate a large portion of both natural and developed upstream catchments in accordance with the landowners agreement discussed in ***Section 1.1***.
- The floodway level is expected to increase by approximately 0.5m, from 5.7m AHD to 6.2m AHD, upstream of the large existing dam. In the proposed development this rise is wholly contained to the drainage corridor and is accepted by the upstream land owners. The minimum finished surface level of the lots adjoining the drainage corridor is a minimum of 6.9m AHD.

Basin walls shall be rebuilt/constructed to geotechnical design.

- The basin walls are to be constructed as outlined in in '*Report on Geotechnical Investigation*' prepared by Cardno dated February 2016.

A report and consultation details with the NSW Dam Safety Committee will also be required.

- Cardno has undertaken a dam break assessment (Cardno 2016) for Basin 1 to determine whether the storage should be prescribed in accordance with requirements of the NSW Dam Safety Committee (DSC). The study considered a cascading failure of three upstream farm dams and Basin 1.

- It was found the Flood Consequence Category is assigned as 'Low' for dam failure occurring during either a flood failure (DCF or PMF) or a sunny day failure event at Basin 1.

- Based on the findings for Basin 1, Cardno was able to infer the Flood Consequence Category of 'Low' for Basin 2. Inference was possible due to the consideration of the upstream catchment characteristics, significantly reduced basin volume and similar proximity to Raymond Terrace Road.

- The study report was submitted to DSC for consideration by the Surveillance Sub-Committee (SSC) on 9 September 2016. Based on the meeting minutes as communicated by a DSC officer, ADW Johnson understands the SSC recommended that Basin 1 and Basin 2 not be prescribed. This recommendation was considered at the full DSC meeting on 21 September 2016. ADW Johnson is currently awaiting written confirmation that the SSC recommendation was upheld at the full DSC meeting.

Key compliances to Councils comments dated 24th March 2016 have been outlined in the cover letter attached to this revision of the SWMP.

Please note that calculations provided to Council regarding McFarlanes Road concept stormwater have been provided in **Appendix D** of this report.

8.0 Conclusion

The SWMP addresses the stormwater management requirements for the proposed residential subdivision of Lots 1 & 2 DP 797020, Lot 1 DP 1144068, Lots 20 & 21 DP 832786, Lot 1 DP1032753, Lot 18 DP 999725 and Lot 1 DP 198776 adjacent to RTR and McFarlanes Road. This cooperative and collaborative approach of the Landowners Group has stormwater management benefits for Council by reducing the number of controls required to be maintained in order to service the proposed urban development of the catchment. This approach is acceptable based on stream order classifications under the NSW Office of Water guidelines. Stormwater management has been approached on a 'whole of catchment' basis, consistent with the collaborative approach of the Landowners Group and additionally provides the detail of the specific controls located on the Allam's site to be constructed as part of their proposed development. The Allam's site is the subject land of the current Development Application for residential subdivision.

There are two (2) existing discharge points from the Allam's site, both of which are culvert crossings underneath RTR. The first discharge point is downslope of the existing dam within Allam's site. This culvert crossing comprises of twin 750mm diameter pipes. The second culvert crossing is close to the intersection of McFarlanes Road and RTR. Both existing culvert crossings under RTR are considered to be currently undersized, unable to convey runoff from the predeveloped catchment for major storm events.

The SWMP addresses both stormwater quantity and quality for the proposed development of the catchment. Specifically, on the Allam's site, Basin 1 is the retrofit and upgrade of the existing dam providing post development stormwater management for subcatchments of adjoining properties to the west. Basin 2 is a new basin at the downstream end of an existing subcatchment within the Allam's site that doesn't drain to the existing dam. The existing discharge locations under RTR are maintained at the same point of discharge locations. Existing dams upstream of the Allam's site and upstream of Basin 1 will be retrofitted and utilised for stormwater management. Specific details of the required stormwater controls and levels will be provided in supplementary reporting when Development Applications are prepared for these sites. Their post development runoff target is to be to pre developed levels for all design storms up to and including the 100 year storm event. We can confirm that all landowner's have cooperated and endorsed this approach.

A stormwater routing model was created using the XPRAFTS software to calculate the peak runoff for the pre developed and post developed catchment conditions up to and including the 100 year design storm. Detention storage has been modelled to limit the peak runoff from the post developed catchment to less than or equal to the peak runoff of the pre developed catchment. The runoff from the smaller subcatchment entering Basin 2 is demonstrated by modelling to be sufficiently attenuated that the 100 year runoff will be conveyed by the existing 750mm diameter pipe culvert crossing. This is an improvement of existing drainage post development.

A MUSIC model was used to simulate pollutant source elements for the proposed development. A water quality system consisting of gross pollutant traps and basins at each discharge point from the Allam's site was then modelled to control pollutants discharging from the proposed development.

The water quality pollutant reduction targets of 80%, 45% and 45% for Total Suspended Solids, Total Phosphorus and Total Nitrogen respectively, have been met at both discharge points prior to the runoff entering both culvert crossings of RTR.

The results from this report demonstrate that the proposed detention and water quality system satisfy Council's requirements in relation to anticipated stormwater runoff from the catchment post development. All relevant authority requirements have been met with this design.

9.0 References

Bureau of Meteorology. (2015). *Climate Data*. Retrieved from *http://www.bom.gov.au/climate/data/index.shtml*

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Maitland City Council. (2014). *Manual of Engineering Standards.* Maitland.

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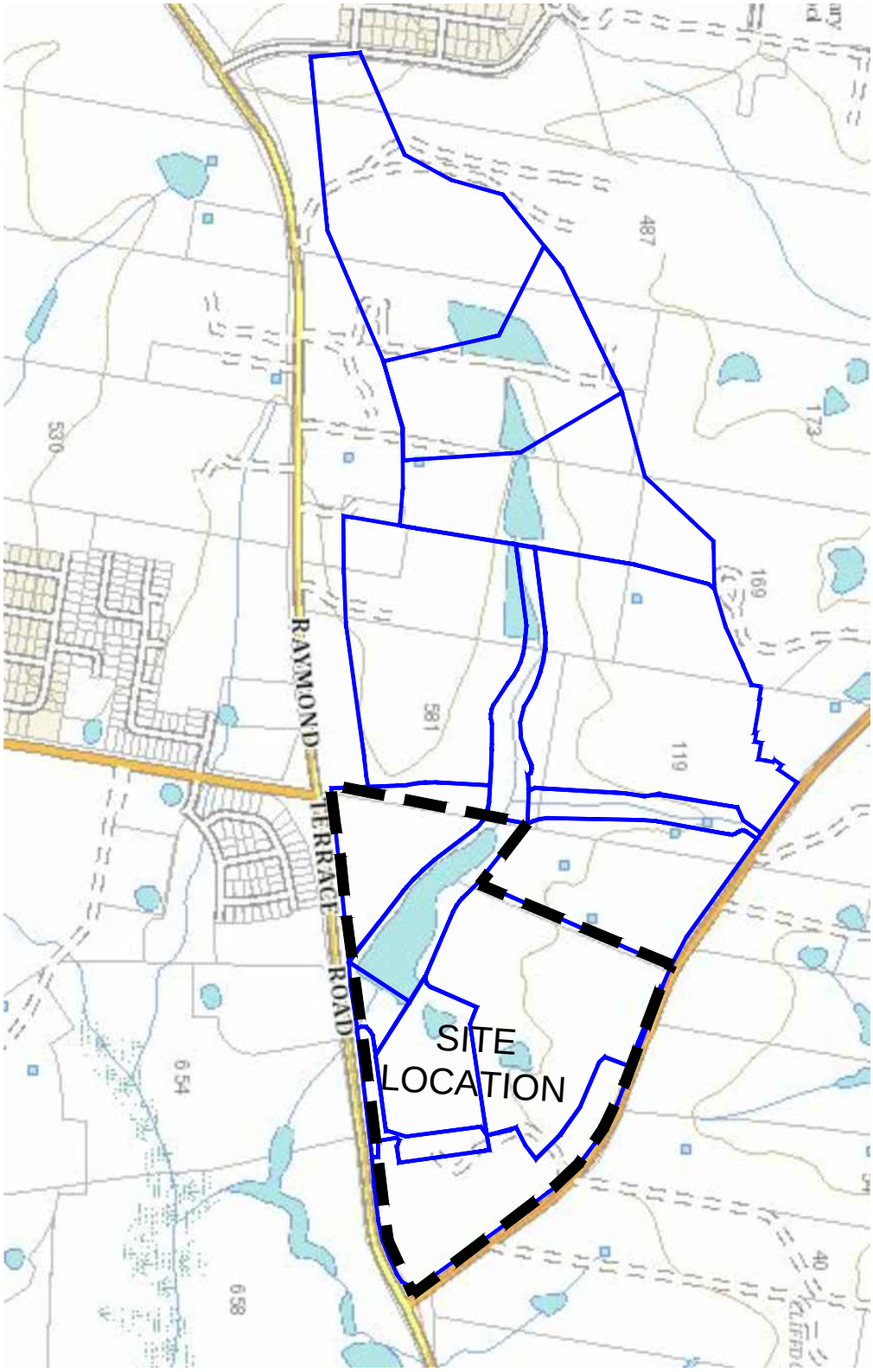
Appendix A

STORMWATER DETENTION

EXHIBIT 1.0 – 1:25,000 TOPOGRAPHIC MAP
EXHIBIT 2.0 – PRE DEVELOPED CATCHMENT PLAN
EXHIBIT 3.0 – POST DEVELOPED CATCHMENT PLAN
EXHIBIT 4.0 – GENERAL ARRANGEMENTS – STORMWATER
EXHIBIT 5.0 – BASIN 1
EXHIBIT 6.0 – BASIN 2
EXHIBIT 7.0 – BASIN 1 TYPICAL X-SECTIONS



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drawing title:

EXHIBIT 1.0

location: CNR OF MCFARLANES ROAD & RAYMOND TERRACE ROAD, CHISHOLM

council: MAITLAND

dwg ref: REP-006

client: ALLAM PROPERTY GROUP

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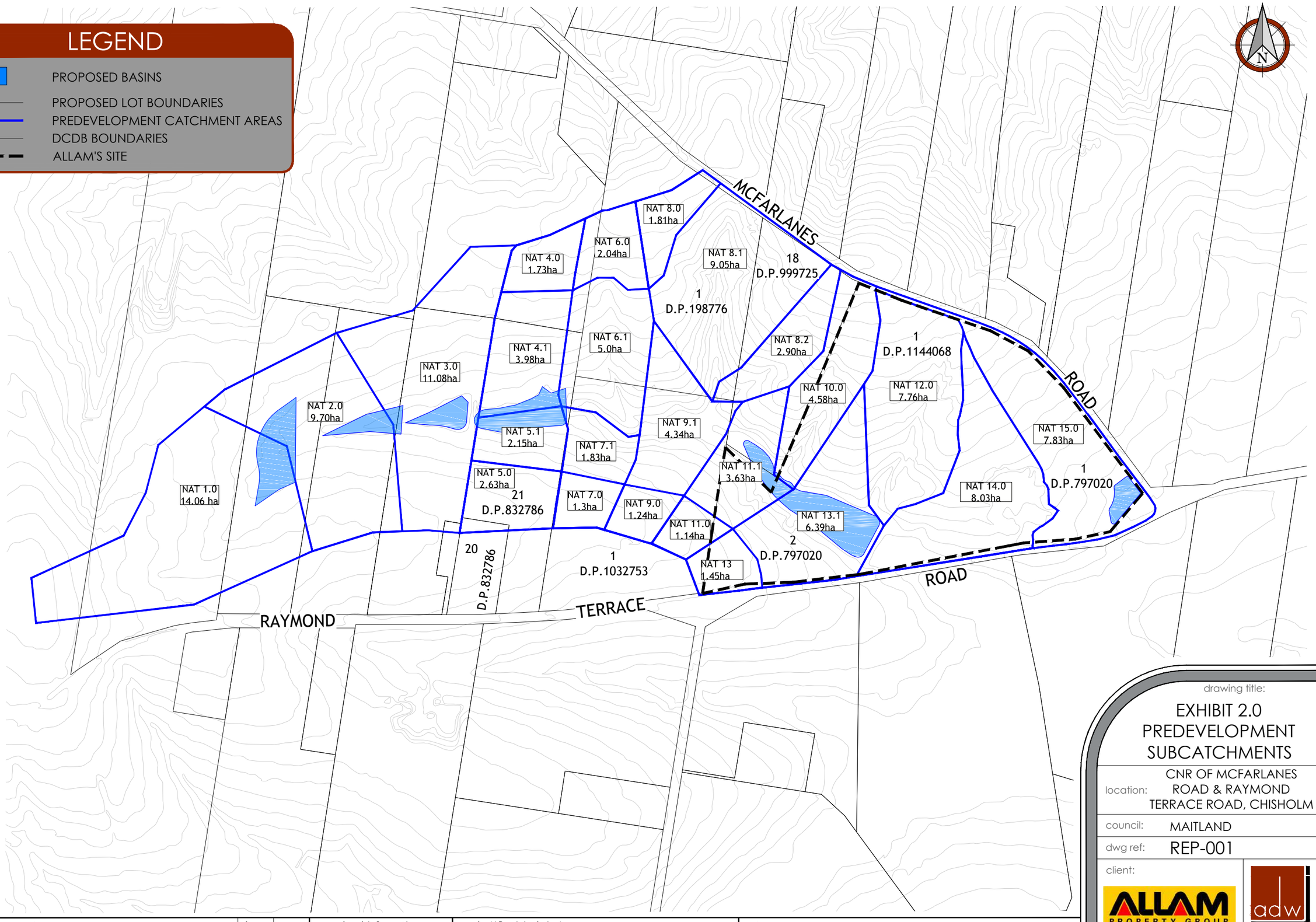
LEGEND

- PROPOSED BASINS
- PROPOSED LOT BOUNDARIES
- PREDEVELOPMENT CATCHMENT AREAS
- DCDB BOUNDARIES
- ALLAM'S SITE



ver.	date	comment	drawn	pm	level information	scale (A3 original size)	notes
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drawing title:

EXHIBIT 2.0 PREDEVELOPMENT SUBCATCHMENTS

location: CNR OF MCFARLANES ROAD & RAYMOND TERRACE ROAD, CHISHOLM

council: MAITLAND

dwg ref: REP-001

client: ALLAM PROPERTY GROUP

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LEGEND

- PROPOSED BASINS
- PROPOSED LOT BOUNDARIES
- POSTDEVELOPMENT CATCHMENT AREAS
- DCDB BOUNDARIES
- WATERCOURSE
- ALLAM'S SITE

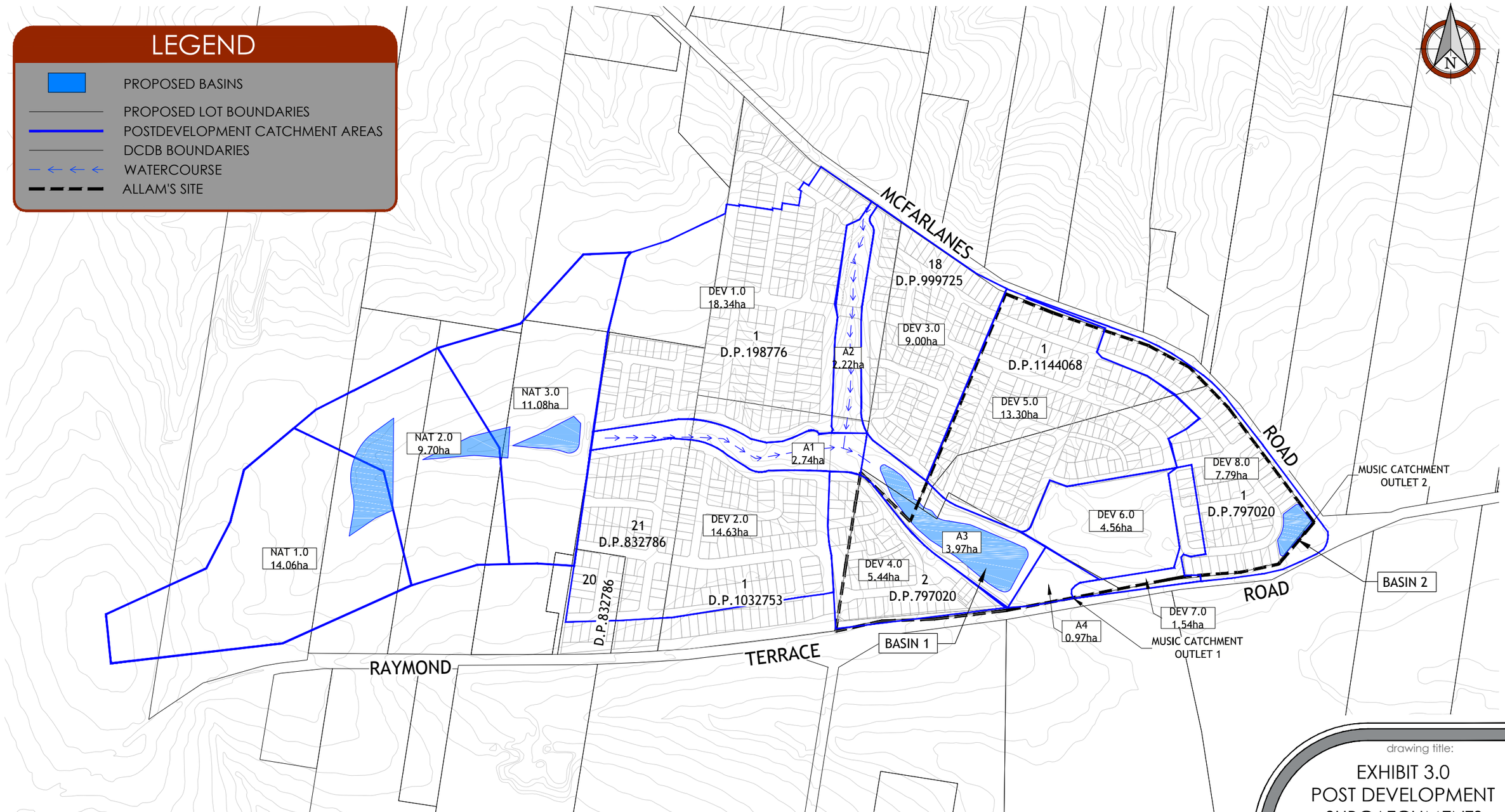

TABLE E1: MUSIC AND CORRESPONDING RAFTS SUBCATCHMENTS

MUSIC SUBCATHCMENT (SECTION 5)	CORRESPONDING RAFTS SUBCATCHMENTS (SECTION 4)
1	NAT 1.0 - 3.0, DEV 1.0 - 7.0 & A1 - A4
2	DEV 8.0

ver.	date	comment	drawn	pm	level information	scale (A3 original size)	notes
B	19.09.16	WATER CATCHMENT REVISED.	C.B.	M.O.	DATUM: AHD (LIDAR) CONTOUR INTERVAL: 2.0m	0 150 300 375m SCALE: 1:7500 (FULL)	

drawing title:

EXHIBIT 3.0 POST DEVELOPMENT SUBCATCHMENTS

location: CNR OF MCFARLANES ROAD & RAYMOND TERRACE ROAD, CHISHOLM

council: MAITLAND

dwg ref: REP-002

client: ALLAM PROPERTY GROUP

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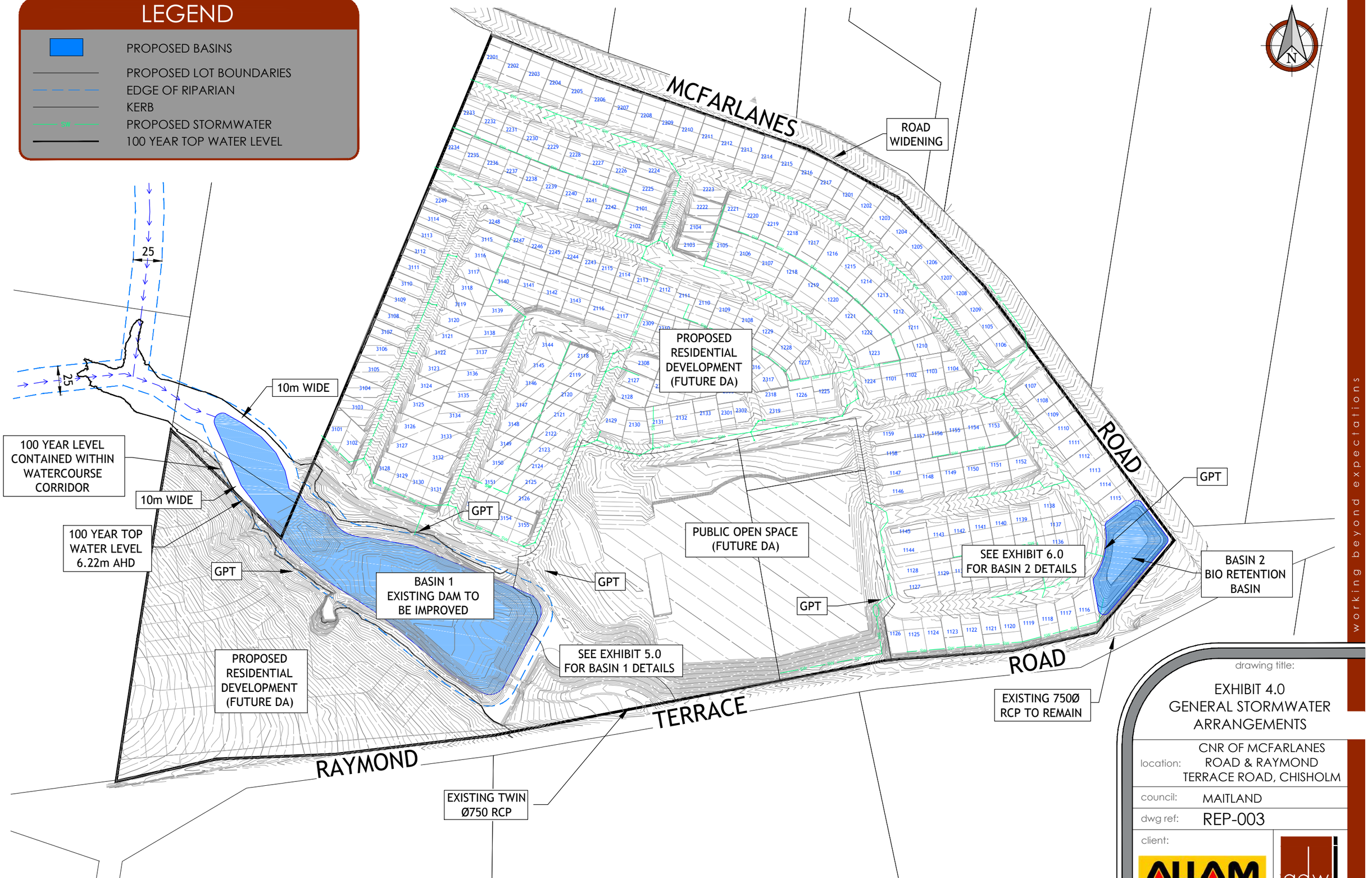
LEGEND

- PROPOSED BASINS
- PROPOSED LOT BOUNDARIES
- EDGE OF RIPARIAN
- KERB
- PROPOSED STORMWATER
- 100 YEAR TOP WATER LEVEL



ver.	date	comment	drawn	pm
B	21.09.16	ISSUE FOR DA.	C.B.	M.O.

level information: DATUM: AHD; CONTOUR INTERVAL: 0.2m

scale (A3 original size): 0 100 200m; SCALE: 1:4000 (FULL)

notes:
1. DESIGN CONTOURS SHOWN ARE CONCEPT ONLY & SUBJECT TO CHANGE THROUGH THE DETAILED DESIGN PHASE

drawing title:

EXHIBIT 4.0 GENERAL STORMWATER ARRANGEMENTS

location: CNR OF MCFARLANES ROAD & RAYMOND TERRACE ROAD, CHISHOLM

council: MAITLAND

dwg ref: REP-003

client: ALLAM PROPERTY GROUP

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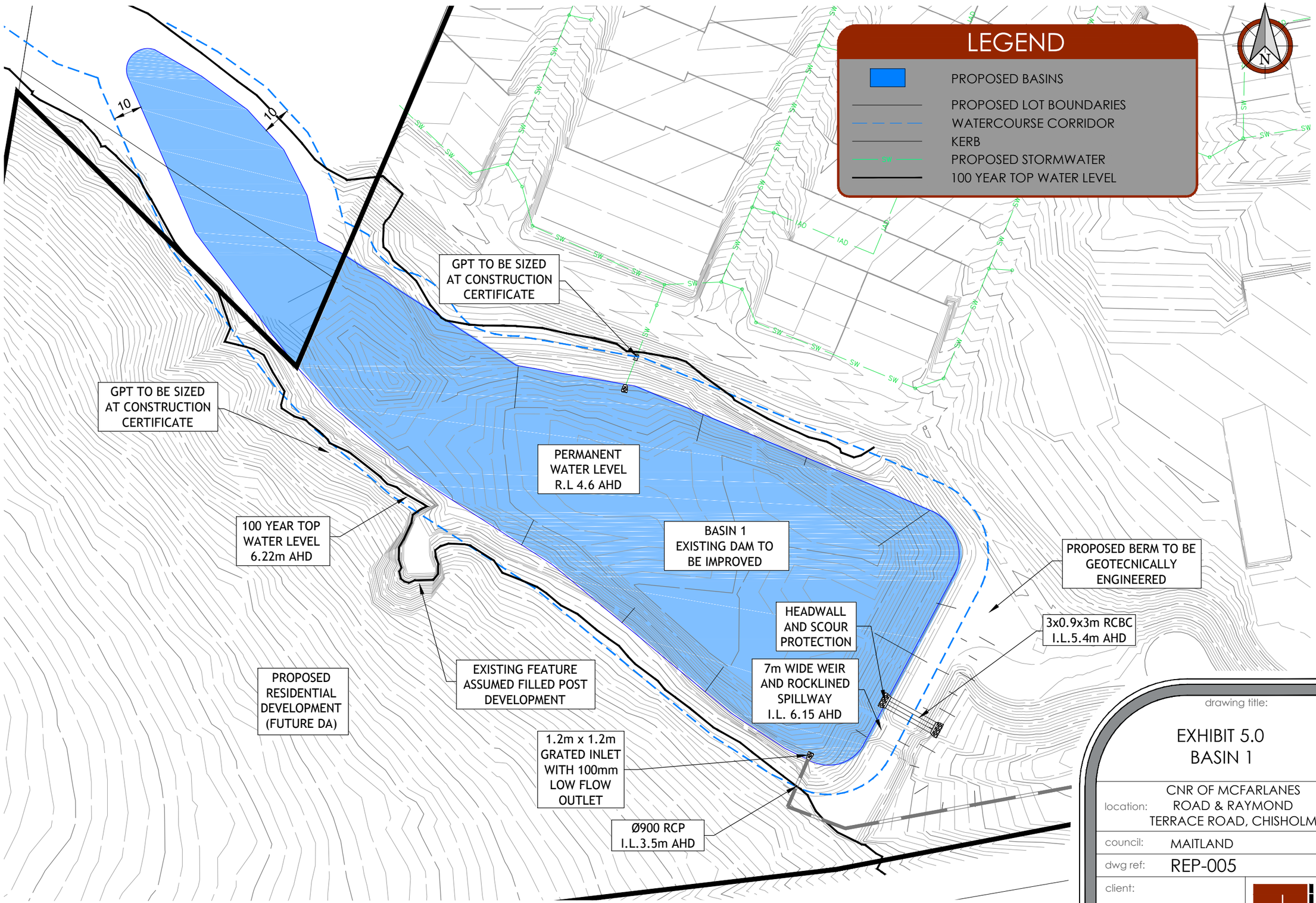

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drawing title:

EXHIBIT 5.0
BASIN 1

location: CNR OF MCFARLANES ROAD & RAYMOND TERRACE ROAD, CHISHOLM

council: MAITLAND

dwg ref: REP-005

client: ALLAM PROPERTY GROUP

ver.	date	comment	drawn	pm	level information	scale (A3 original size)	notes
B	21.09.16	ISSUE FOR DA.	C.B.	M.O.	DATUM: AHD CONTOUR INTERVAL: 0.2m	0 25.0 50.0 62.5m SCALE: 1:1250 (FULL)	1. DESIGN CONTOURS SHOWN ARE CONCEPT ONLY & SUBJECT TO CHANGE THROUGH THE DETAILED DESIGN PHASE

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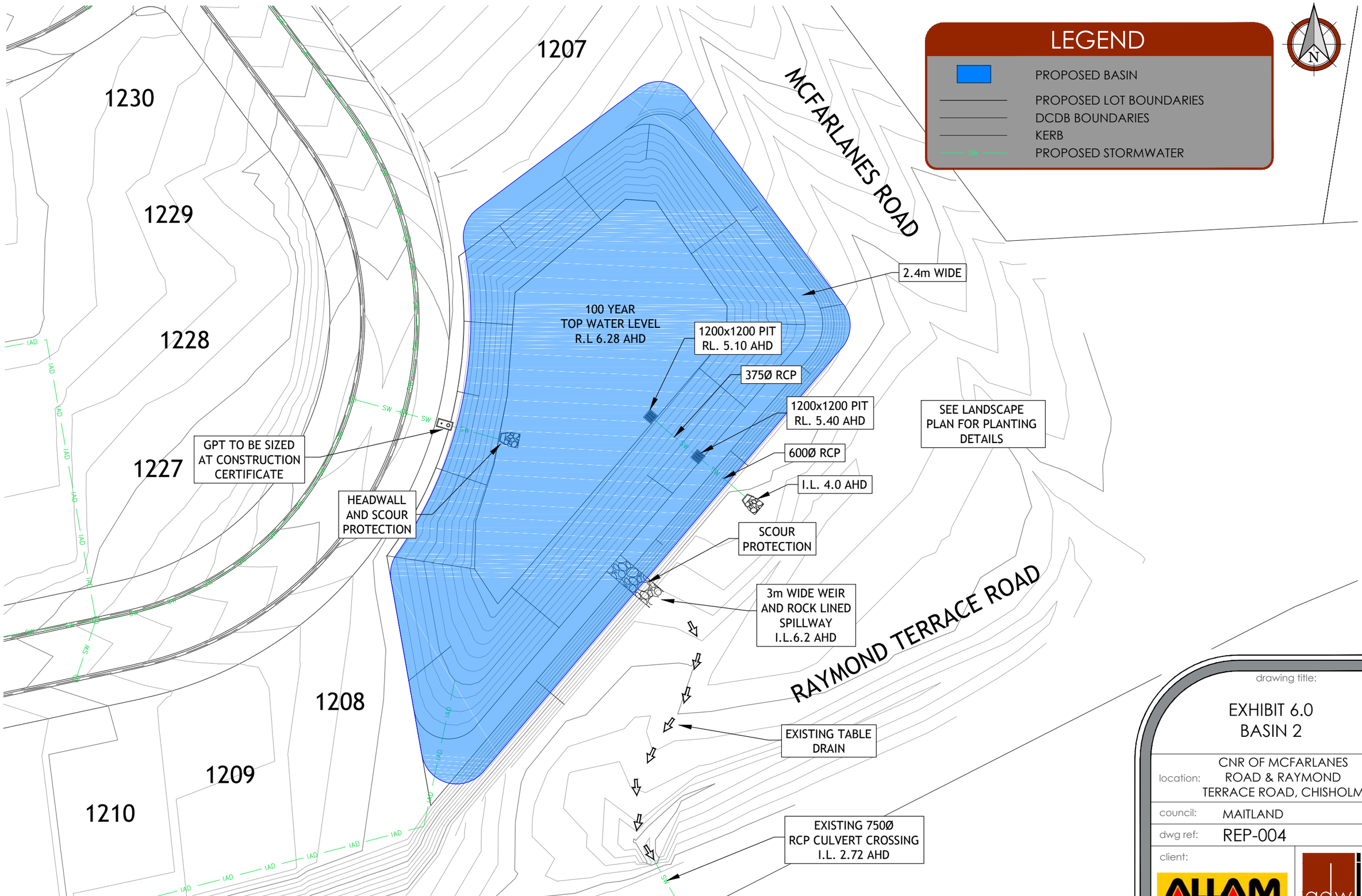
Plotted By: Chris Brown Plot Date: 04/10/16 2:42:25PM Cad File: N:\190205\DWG\190205-REP-005-B.DWG

190205-REP-004-B



ver.	date	comment	drawn	pm	level information	scale (A3 original size)	notes
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drawing title:

EXHIBIT 6.0
BASIN 2

location: CNR OF MCFARLANES ROAD & RAYMOND TERRACE ROAD, CHISHOLM

council: MAITLAND

dwg ref: REP-004

client: ALLAM PROPERTY GROUP

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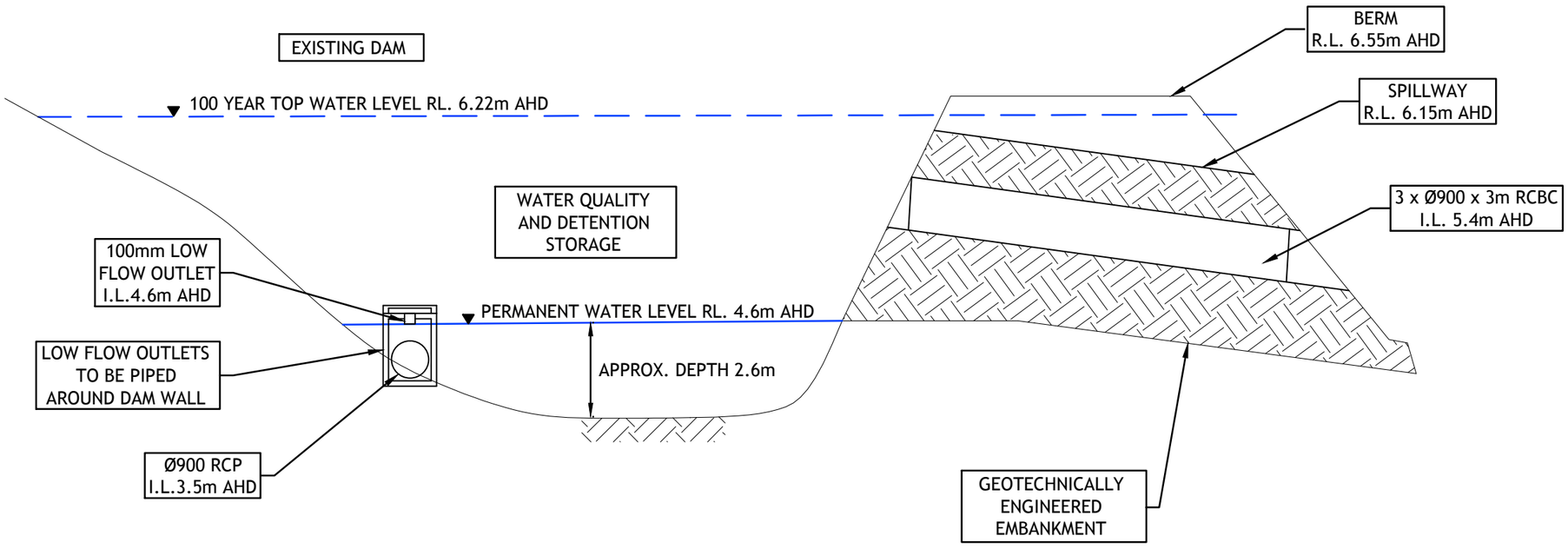

NOTE: DO NOT SCALE OFF THIS DRAWING.
TYPICAL X-SECTION SHOWN AS INDICATIVE ONLY
AND FOR DIAGRAMMATIC PURPOSES ONLY.

ver.	date	comment	drawn	pm	level information	scale (A3 original size)	notes
C	05.10.16	ISSUE FOR DA	C.B.	M.O.	DATUM: N/A CONTOUR INTERVAL: N/A	NOT TO SCALE	

drawing title:
EXHIBIT 7.0
BASIN 1
TYPICAL X-SECTION

location: CNR OF MCFARLANES ROAD & RAYMOND TERRACE ROAD, CHISHOLM

council: MAITLAND

dwg ref: REP-007

client: ALLAM PROPERTY GROUP

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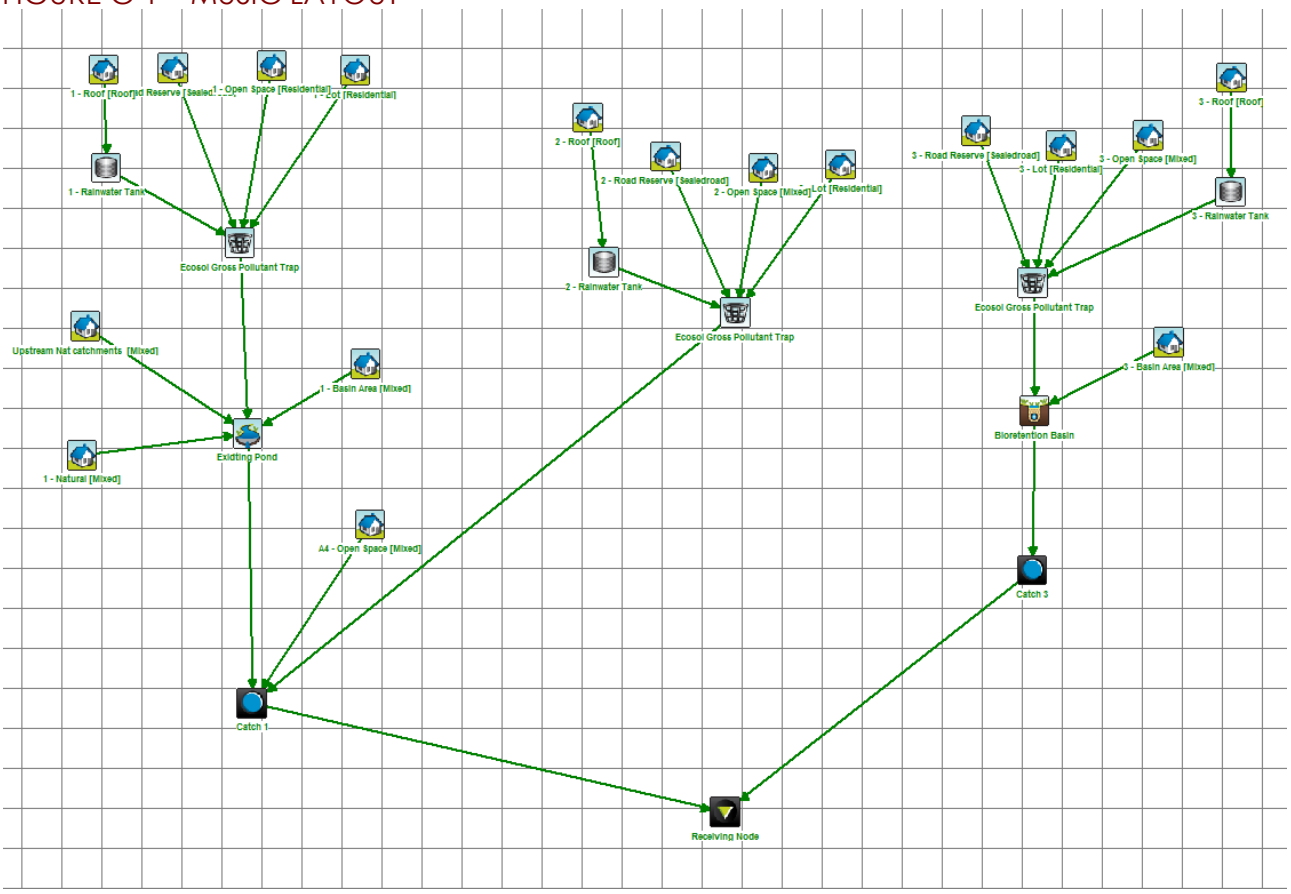
Appendix B

STORMWATER QUALITY

FIGURE C-1 – MUSIC LAYOUT



Appendix C

EROSION AND SEDIMENT CONTROL

FIGURE E-1 – Erosion and Sediment Control Plan

190205-DA-141-B

SOPHIA WATERS CHISHOLM

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TEMPORARY SEDIMENT BASIN TO BE USED DURING CONSTRUCTION. SIZED IN ACCORDANCE WITH MANAGING URBAN STORMWATER: SOILS AND CONSTRUCTION - 4TH ED. (LANDCOM - 2004).

(S94 OPEN SPACE - FUTURE DA)

(FUTURE DA)

STOCK PILE

(S94 OPEN SPACE - FUTURE DA)

TEMPORARY SEDIMENT BASIN TO BE USED DURING CONSTRUCTION. SIZED IN ACCORDANCE WITH MANAGING URBAN STORMWATER: SOILS AND CONSTRUCTION - 4TH ED. (LANDCOM - 2004).

STORMWATER CONTROL FACILITY TO BE USED AS TEMPORARY SEDIMENT BASIN DURING CONSTRUCTION

LEGEND

- EXTERNAL DA BOUNDARY
- PROPOSED STORMWATER
- SILT FENCE
- NO-GO FENCE
- DIVERSION DRAIN
- GRAVEL BAGS
- SITE ACCESS
- DISTURBED AREA

ver.	date	comment	drawn	pm	level information	scale (A3 original size)	notes
B	23.09.16	ISSUE FOR DA.	C.B.	M.O.	DATUM: AHD CONTOUR INTERVAL: 0.2m	0 60 120 150m SCALE: 1:3000 (FULL)	1. BACKGROUND IMAGE SOURCED FROM GOOGLE EARTH 2. DESIGN CONTOURS SHOWN ARE CONCEPT ONLY & SUBJECT TO CHANGES THROUGH THE DETAILED DESIGN PHASE

drawing title:

EROSION & SEDIMENTATION CONTROL PLAN

location: CNR. OF MCFARLANES ROAD & RAYMOND TERRACE ROAD, CHISHOLM

council: MAITLAND

dwg ref: DA-141

client: ALLAM PROPERTY GROUP

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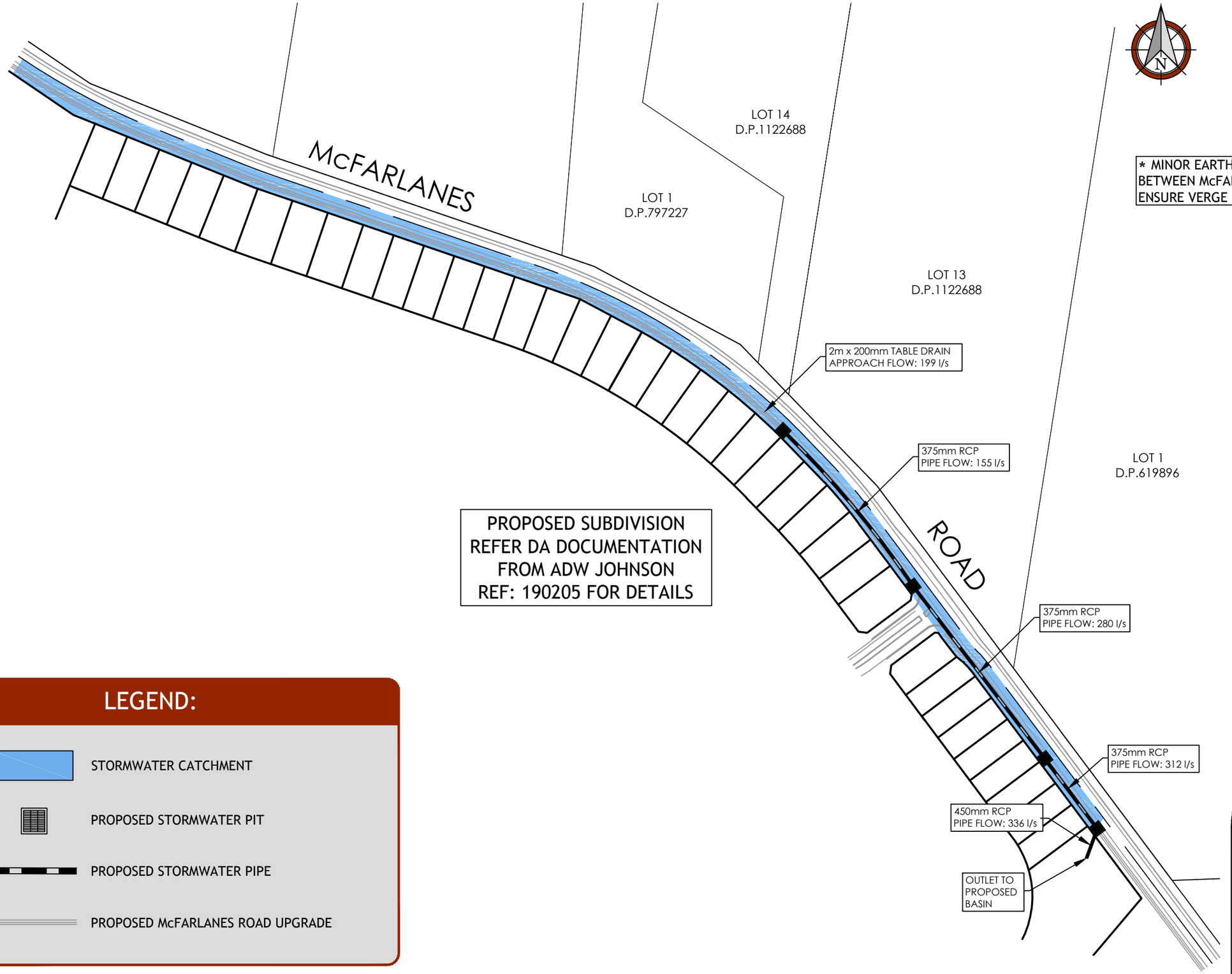
Appendix D

MCFARLANES ROAD CONCEPT STORMWATER CALCULATIONS

190205-PSK-026-A



* MINOR EARTHWORKS REQUIRED AT INTERFACE BETWEEN McFARLANES ROAD AND DEVELOPMENT TO ENSURE VERGE FALLS TO TABLE DRAIN

PROPOSED SUBDIVISION
REFER DA DOCUMENTATION
FROM ADW JOHNSON
REF: 190205 FOR DETAILS

LEGEND:

- STORMWATER CATCHMENT
- PROPOSED STORMWATER PIT
- PROPOSED STORMWATER PIPE
- PROPOSED McFARLANES ROAD UPGRADE

ver.	date	comment	drawn	pm	level information	scale (A3 original size)	notes
A	14.09.16	INITIAL ISSUE	D.B.	L.G.	DATUM: N/A CONTOUR INTERVAL: N/A	NOT TO SCALE	1. DESIGN INFORMATION SHOWN ON THIS PLAN IS CONCEPT ONLY AND SUBJECT TO FINAL DESIGN DURING THE CONSTRUCTION CERTIFICATE PHASE.

drawing title:

McFARLANES ROAD CONCEPT STORMWATER CALCULATIONS

location: CNR. OF MCFARLANES ROAD & RAYMOND TERRACE ROAD, CHISHOLM

council: MAITLAND

dwg ref: PSK-026

client: ALLAM PROPERTY GROUP

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